

# CHAPTER 4

## A Possible Japanese Nuclear Force: Motivations and Practical Challenges

*Gregory S. Jones*

### *Introduction*

In spring of 2013, Japanese officials, as well as South Koreans and North Atlantic Treaty Organization (NATO) members, were given tours of U.S. strategic nuclear installations. These included the headquarters of the U.S. Strategic Command, a control center for Minuteman intercontinental ballistic missiles and an Ohio-class nuclear ballistic missile submarine. The ostensible reason for the visits was to reassure U.S. allies about the robustness of the U.S. nuclear deterrent in the face of nuclear arms reductions but it was also noted that another reason was to help prevent Japan and South Korea from going nuclear in the face of North Korea's nuclear weapons.<sup>1</sup>

At first thought, the notion that Japan would develop nuclear weapons seems very unlikely. Having the only two cities in the world to have ever been attacked by nuclear weapons, Japan has a well-known “nuclear allergy” to such weapons. Also since 1971 Japan has had the “Three Non-Nuclear Principles” which are that Japan would never allow the manufacture, possession, or importation of nuclear weapons. However, these Non-Nuclear Principles are

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1. Yoshihiro Makino, “U.S. shows nuclear facilities to reassure Japan, allies of deterrence,” *Asahi Shimbun*, July 30, 2013.

pledges and do not have any formal legal foundation.

Yet the need to reassure Japan about the robustness of the U.S. nuclear deterrent shows that for a variety of reasons the thought that Japan might acquire its own nuclear weapons is not nearly as far-fetched as it used to be. Should Japan decide to acquire nuclear weapons, it has many nuclear power related, military, and space-launch resources that would allow it to quickly develop many nuclear weapons and the needed delivery systems.

This paper will first examine the factors that could help propel Japan towards the acquisition of nuclear forces. Then it will examine the resources from Japan's nuclear power, military, and space launch programs that will aid Japan in acquiring nuclear forces. Next, the paper will examine possible stages of development of a Japanese nuclear force, the problematic aspects of a Japanese nuclear force and finally provide a summary and conclusions.

### *Motivators for a Japanese Nuclear Force*

#### North Korea

North Korea's acquisition of nuclear weapons is a major motivator for Japan to acquire nuclear weapons. North Korea tested its first nuclear weapon in October 2006. However, due to the low yield of this test, there were many, including in the U.S. government, who considered the test at least a partial failure. Since there are other explanations for the test's low yield, this need not have been the case. At any rate, since that time North Korea has tested nuclear weapons four more times, in May 2009, February 2013, January 2016, and September 2016. The yields of the last three tests were roughly 5 to 15 kilotons and many analysts believe that the January 2016 test may have been boosted. Though the United States and other nations have formally refused to acknowledge that North Korea is a nuclear

weapon state, there seems little doubt that it is, a fact that Japan has begun to face. North Korea has developed a significant centrifuge enrichment facility and has restarted its plutonium production reactor at Yongbyon, putting it in a position to significantly expand its nuclear arsenal.

North Korea has also shown it is not likely to be a peaceful neighbor. In March 2010 North Korea torpedoed and sank a South Korean frigate and in November 2010 it shelled the inhabited South Korean island of Yeonpyeong. In December 2012 and February 2016 North Korea continued to develop its ballistic missile capability by testing long-range missiles which North Korea has called satellite launchers. Such long-range missiles are not needed for North Korea to target Japan. In August 2016, North Korea successfully tested a submarine-launched ballistic missile which flew towards Japan. North Korea's *Nodong* missile, which has been deployed since the 1990s, can target most of Japan including Osaka and Tokyo. In September 2016, North Korea fired a salvo of three of these missiles towards Japan.<sup>2</sup> After five nuclear tests it is very likely that North Korea has developed a nuclear weapon that could be carried by the *Nodong* missile. There is no evidence that North Korea has ever tested a *Nodong* with a simulated nuclear warhead but it is not clear that North Korea would need to. Pakistan uses North Korea's *Nodong* missile, which it calls the *Ghauri*, as a nuclear weapon delivery vehicle. Given the high level of cooperation between Pakistan and North Korea on nuclear and ballistic missile technology, it is possible that Pakistan may have already provided North Korea with the technology to equip its *Nodong* missiles with nuclear weapons.

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2. Su-Hyun Lee, "North Korea Test-Fires 3 Missiles Toward Japan, Seoul Says," *The New York Times*, September 5, 2016

## China

China has been rapidly growing economically for some time. This growth is translating into increased military power transforming China into a major power in the Western Pacific. This development in and of itself need not be a problem for Japan. However, China has various territorial disputes with a great number of its neighbors and China's actions in the last decade have demonstrated that it intends to aggressively pursue these claims.

China has laid claim to the Japanese-controlled Senkaku Islands. This is a group of small islands located near the southern end of the Japanese Ryukyu Island chain, only about 170 kilometers northeast of Taiwan and a similar distance from the nearest Japanese islands in the Ryukyu Island chain. The eight islands are unimportant in themselves, having a total area of only 1,700 acres. However, ownership of the islands could allow the development of possible oil and gas resources in the surrounding ocean though China's actions may simply be the result of its growing nationalism.

Since 2008, and especially since 2012, Chinese naval vessels have intruded into Japan's territorial waters around these islands as well as other islands that are uncontested Japanese territory.<sup>3</sup> Also since the end of 2012, Chinese aircraft, including military aircraft, have violated the airspace around the islands and flown near Japanese airspace, leading Japan to scramble interceptor aircraft. In the six months from April 1, 2016, to September 30, 2016, the number of Japanese aircraft scrambled due to Chinese military aircraft was 407, which is an all-time high.<sup>4</sup> Showing how aggressively China will pursue this claim, in 2013 China significantly escalated this dispute by having various semi-official groups (such as scholars, analysts, and former military officials) question Japan's sovereignty to the entire Ryukyu Island chain which includes Okinawa with 1.3

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3. Japan Ministry of Defense, *Defense of Japan, 2016*, Tokyo, 2016, p. 6.

4. Tim Kelly and Nobuhiro Kubo, "Japan jet scrambles against Chinese aircraft hit six-month record," *Reuters*, October 14, 2016.

million Japanese inhabitants.<sup>5</sup>

In October 2013, the dispute continued to escalate with Japan scrambling its aircraft three times in a single week in response to Chinese military aircraft flying near Okinawa. Japan's defense minister, Itsunori Onodera, said that China's behavior was jeopardizing peace. In response to a Chinese drone flying near the Senkaku Islands, Japan approved defense plans calling for Japanese Air Force planes to shoot down such drones. In turn, China's Defense Ministry said that any attempt by Japan to shoot down Chinese aircraft "would constitute a serious provocation, an act of war of sorts."<sup>6</sup>

At the end of November 2013 matters further escalated with China's declaration of an "air defense identification zone" over the East China Sea. China's Defense Ministry said aircraft in the zone must report a flight plan, maintain two-way radio communications, and respond in a timely and accurate manner to identification inquiries. This zone significantly overlaps Japan's own air defense identification zone and includes the Senkaku Islands. Japan's Prime Minister Shinzo Abe called the Chinese zone "dangerous."<sup>7</sup> Both the United States and Japan have deliberately flown flights into the zone without reporting to China.

Nor is Japan the only country to experience China's aggressive tactics. For many years China has had a dispute with Vietnam, the Philippines, Malaysia, and Brunei over China's claim to what amounts to the entire South China Sea. In May 2014, a Chinese naval vessel rammed and sank a Vietnamese fishing vessel in the vicinity of a

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5. Jane Perlez, "Calls Grow in China to Press Claim for Okinawa," *The New York Times*, June 13, 2013 and Justin McCurry, "China lays claim to Okinawa as territory dispute with Japan escalates," *Guardian*, May 15, 2013.

6. "Japan minister: China threatens peace in islands row," *BBC News*, October 29, 2013.

7. "Shinzo Abe: China new air defense zone move 'dangerous,'" *BBC News Asia*, November 25, 2013.

Chinese oil rig parked in disputed waters off Vietnam's coast.<sup>8</sup> By 2016 China had turned Subi Reef into an island with a 10,000 foot runway. In July 2016, an international tribunal in The Hague ruled in favor of the Philippines and against China in this dispute. Regarding this ruling, China's Foreign Ministry said, "China does not accept or recognize it."<sup>9</sup> Japan has concerns that China may adopt a similar high-handed approach to the Senkaku Islands dispute.

Nor is the Pacific region the only area where China is aggressively pressing its territorial claims. During 2013 and 2014, Chinese troops repeatedly entered Indian-controlled Kashmir. In one case the Chinese troops camped about 10 kilometers inside Indian territory for about three weeks. In 2016, there was a similar incident as Chinese troops set up tents 6 kilometers inside Indian territory before Indian forces confronted them and had them withdraw. In the 1960s, Chinese troops invaded and for a time occupied the eastern Indian state of Arunachal Pradesh. China has continued to lay claim to this state since that time but it has only been in the last decade that China has started refusing to issue normal visas to Indian citizens from Arunachal Pradesh, implying that they are not Indian citizens. In 2016 Chinese troops tried to enter this area leading to an unarmed scuffle between Chinese and Indian forces.<sup>10</sup> All of these events illustrate that as China's power grows it will not be an easy neighbor to live with.

In June 2014, Shinichi Kitaoka, the acting chairman of Japan's Advisory Panel on Reconstruction of the Legal Basis for Security, summarized the growing threats from North Korea and China:

In 2007 we were just facing North Korean belligerent-

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8. Jane Perlez, "China and Vietnam Point Fingers After Clash in South China Sea," *The New York Times*, May 27, 2014.

9. Jane Perlez, "Tribunal Rejects Beijing's Claims in South China Sea," *The New York Times*, July 12, 2016.

10. "Scuffle at border as Indian troops counter aggressive Chinese incursions in Arunachal Pradesh," *The Times of India*, June 15, 2016.

cy. Since then, we have had the eruption of the Senkaku incidents, the persistent entry of Chinese ships into Japanese territorial waters, and other provocations and unilateral actions. Many worrying developments have happened with North Korean missiles and nuclear tests. Behind that, the Chinese military budget that we know of has quadrupled in the last decade. Frankly, the security situation has deteriorated significantly and rapidly.<sup>11</sup>

### South Korea

It is not anticipated that South Korea will pose any direct threat to Japan. However, South Korea has been more directly affected by the nuclear threat from North Korea and as was discussed above has already suffered direct North Korean conventional attacks on its military vessels and territory. As a result, a number of South Koreans have been more open about their desire for South Korea to acquire its own nuclear weapons to counter North Korean ones. These calls for nuclear weapons became more strident in the aftermath of North Korea's February 2013 nuclear test.<sup>12</sup>

The South Korean government has thus far not heeded these calls to acquire nuclear weapons. However, in May 2014, South Korea's President Park Geun-hye obliquely threatened that South Korea might develop nuclear weapons in the face of another North Korean nuclear test. She stated that one effect of a new North Korean nuclear test would be the prospect of nearby countries fearing they needed to develop their own nuclear arsenal. "It would be difficult

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11. Paul Kallender-Umezu, "Interview: Shinichi Kitaoka," *Defense News*, June 9, 2014, p.22.

12. David E. Sanger, "In U.S., South Korean Makes Case for Nuclear Arms," *The New York Times*, April 9, 2013.

for us to prevent a nuclear domino from occurring in this area.”<sup>13</sup> In 2016, Won Yoo-chul, the ruling Saenuri Party’s floor leader said in a speech to the National Assembly, “We cannot borrow an umbrella from a neighbor every time it rains. We need to have a raincoat and wear it ourselves.”<sup>14</sup>

Another indicator of South Korean interest in nuclear weapons is its push to acquire reprocessing technology to produce separated plutonium as well as enrichment technology that could be used to produce highly enriched uranium. South Korea’s nuclear cooperation agreement with the United States was recently renegotiated. Under the terms of its old agreement, South Korea was not permitted to reprocess nuclear power reactor fuel to recover plutonium or to have enrichment technology. During the negotiations for the new nuclear cooperation agreement, South Korea pushed very hard to be allowed to conduct reprocessing and enrichment in South Korea. The new agreement does not directly allow either but it does allow South Korea to send its spent fuel overseas with the potential to have the plutonium sent back in the form of reactor fuel and opens a pathway for enrichment in South Korea.

In the past such South Korean interest in acquiring power reactor plutonium would be justified by saying that the plutonium would be recycled in nuclear power reactors but such programs have not been very successful, including Japan’s own plutonium recycling program. It is unlikely that South Korea’s sudden interest in plutonium is driven by nuclear power economics. Rather it is far more likely that it is driven by the plutonium’s potential use in nuclear weapons. If South Korea were to acquire its own nuclear weapons, it could significantly increase the pressure on Japan to acquire its own nuclear weapons.

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13. Gerard Baker and Alastair Gale, “South Korea Warns of Nuclear Arms Race,” *Wall Street Journal*, May 30, 2014, p.A8.

14. “Top South Korean lawmaker calls for nuclear arms,” *Japan Times*, February 15, 2016.



## United States

Japan depends on the United States to provide a nuclear umbrella to protect against nuclear threats from China and North Korea and also depends on the overall military strength of the United States to protect it from Chinese conventional military threats. However, the last decade has been very hard on the U.S. economy with economic growth being fairly moderate ever since the 2008 collapse. The long wars in Iraq and Afghanistan have made the U.S. public weary of any overseas military commitments. The U.S. government's lack of resolve over Syria's large-scale use of chemical weapons, and the U.S. government shutdown and near default on its debt have raised questions about the competence of U.S. governance. The repeated failure of the U.S. Congress to pass a timely budget has led to Sequestration which has adversely impacted the U.S. defense budget. The takeover of large parts of Iraq by Islamic extremists and the air campaign against these extremists in Iraq and Syria makes it likely that the much touted U.S. "pivot" to East Asia may be very much delayed.

The United States has tried to significantly improve relations with India over the past decade and has tried to enlist India as an ally should there be a confrontation with China. However, India has been wary of aligning itself too closely with the United States in part because, based on current trends, India is not sure that the United States is likely to prevail over China in the long-term. Similarly in October 2016, Philippine President Rodrigo Duterte stated on a visit to China, "America has lost now. I've realigned myself in your [China's] ideological flow."<sup>15</sup> If this perception of U.S. decline, especially a perception of relative decline compared to China continues to grow, then in the longer-term, Japan may not want to continue to be so dependent on the United States to deter nuclear threats from China and North Korea.

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15. Katie Hunt, Matt River, and Catherine E. Shoichet, "In China, Duterte announces split with US: 'America has lost,'" *CNN*, October 20, 2016.

### Continued Erosion of Nonproliferation Norms

Over the past two decades, U.S. and Western efforts to promote the nonproliferation of missile, chemical, and nuclear weapons have been declining in effectiveness. Compliance with the Missile Technology Control Regime (MTCR) has never been perfect. For example, both China and Russia have exported missiles and missile-related technology that they have falsely claimed had a range of “290 kilometers” so as to exempt them from the MTCR’s 300 kilometer range limit. More recently the United Kingdom (UK) sold the *Storm Shadow* cruise missile to Saudi Arabia, which would appear to be a violation of the UK’s MTCR commitments. In October of 2012, the United States gave South Korea permission to develop an 800 kilometer range ballistic missile that can carry a 500 kilogram payload. Such a missile is clearly beyond the MTCR guidelines though the U.S. State Department implausibly claimed that since this development was indigenous and not the result of missile exports, it did not contravene the MTCR.<sup>16</sup>

On August 21, 2013, Syria conducted large-scale chemical weapon attacks against rebel-held areas using the nerve agent sarin, exposing many thousands and killing at least many hundreds. This attack was the first time in 25 years that a nation has employed chemical weapons on such a large scale. The world’s reaction to this serious breach of nonproliferation norms was underwhelming. Though France came out strongly in favor of taking military action against Syria, the UK went “wobbly,” as the late Margaret Thatcher would have said, with the British parliament voting against taking any military action against Syria. The United States took a very deliberate approach with President Barack Obama trying to get the support of Congress before taking any military action. But the statements of some U.S. lawmakers indicated that they did not see any value in taking military action to punish Syria for its use of chemical weapons and to deter Syria from any further use. Such statements indicate that these

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16. Kelsey Davenport, “South Korea Extends Missile Range,” *Arms Control Today* 42, no. 9, November 2012.

lawmakers may not be committed to maintaining nonproliferation norms, which is a rather disturbing development. Though Syria has now disposed of its chemical weapons under international supervision, the impression remains that the world was not willing to take military action to prevent the large-scale use of chemical weapons.

In July 2015, the U.S. entered into a nuclear agreement with Iran (the Joint Comprehensive Plan of Action) which legitimized Iran's illicit uranium enrichment program by granting Iran the "right to enrich." After 15 years Iran will have an unrestricted enrichment program and be allowed to reprocess spent fuel to produce separated plutonium. These concessions will put Iran in a position to acquire nuclear weapons whenever it wishes.

Further, as was discussed above, although the United States had stated that it was "unacceptable" for North Korea to acquire nuclear weapons, it has in fact done so. Based on these events, the West's support for the principles of non-proliferation of weapons of mass destruction seems to be declining.

### Japanese Demographics

The birthrate in Japan, like that of most industrialized countries, is insufficient to maintain its current population. However, in other industrialized countries, immigration is sufficient to keep the population expanding. This is not the case for Japan and its population has been declining for the past several years. In 2013 Japan's population fell by about one-quarter million and it is projected that by 2040 Japan's population may have fallen by over 20 million from its peak of 128 million in 2010.<sup>17</sup>

What is worse, Japan's population structure is aging, so that the decline in military age Japanese will, proportionately, be even greater. Already the military aged Japanese population has dropped 40%

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17. "Japan's depopulation time bomb," *Japan Times*, April 17, 2013.

(from about 17 million to 11 million) since 1994.<sup>18</sup> Japan may find it hard to maintain a sufficiently large conventional military to defend Japan, especially in light of a growing Chinese threat. Japan might consider the development of nuclear weapons as a means of maintaining a rough balance with China.

### Summary of Motivators for a Japanese Nuclear Force

If U.S. economic and military power continues to decline, Japan may feel less confident of being protected by the U.S. nuclear umbrella. This, combined with the growth of China's economic and military power, China's continued aggressive pursuit of its territorial claims, and North Korea's continued belligerence and expansion of its nuclear forces, could result in Japan facing a more serious regional threat. Japan's aging and declining population may make it hard for Japan to defend against these threats conventionally. If these developments are combined with a continuing decline in nonproliferation efforts and result in South Korea acquiring nuclear weapons, Japan may feel impelled to acquire nuclear weapons in order to protect its security. It is by no means foreordained that such a future will occur but such a future is certainly possible given current trends.

### *The Threat*

#### North Korea and China

Any Japanese nuclear weapon program is going to be strongly influenced by the threat that it is designed to counter. This paper assumes that the Japanese will intend for its nuclear weapon program to deter or retaliate against a nuclear attack or to deter or disrupt a conven-

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18. See, Figure II-2-5-1 "Changes in Number of People Eligible to Join the SDF," *Defense of Japan, 2016*, Tokyo, 2016.

tional invasion of its territory. In the foreseeable future only North Korea and China could provide a nuclear threat and only China could carry out a conventional invasion of Japan.

North Korea's nuclear force is likely to consist of tens of implosion fission weapons with a yield of probably 10 to 20 kilotons. However, most of these weapons would likely be reserved for use against either U.S. military forces or South Korean targets which could be either military forces or cities. Probably only a handful of North Korean nuclear weapons would be allocated to target Japan in the hope of inducing Japan to drop out of any conflict in which it was supporting the United States and South Korea. To attack targets in Japan, North Korea would need to utilize its *Nodong* ballistic missiles in order to reach Japan, though nuclear weapon delivery by special forces would be an outside possibility. Given the small number of weapons and that the *Nodong* can only effectively attack large targets due to its inaccuracy, North Korea would almost certainly target Japanese cities.

Even a single North Korean nuclear weapon exploded over a Japanese city would cause great devastation. If exploded over Tokyo, about 100,000 people would be killed and a similar number injured. Though this would be a catastrophe, it would not be the apocalypse that most people assume. Since a single 16 kiloton weapon was sufficient to destroy Hiroshima, most people assume that a similar yield weapon would be sufficient to destroy any modern city. This assumption ignores the great increase in size and population of modern cities. Just the central urban core of Tokyo (the 23 wards) is about 30 times the size and population of World War II Hiroshima. Modern Tokyo could absorb a number of 10 to 20 kiloton weapon blasts without ceasing to function.

The nuclear threat from China is far more serious. China has about 200 nuclear weapons, most of which are two-stage thermonuclear weapons with yields from the low hundreds of kilotons to a few

megatons.<sup>19</sup> These weapons are carried on a variety of ballistic missiles. The long-range versions of these missiles (DF-31, DF-31A, DF-5A, DF-5B and DF-4) are presumably targeted on North America and Europe. This leaves the 80 or so shorter range DF-21 missiles (2,150 km range) to be allocated to target China's regional threats. Since threats could exist in almost any direction, it is likely that only about 20 or so of these missiles are allocated to China's northeast, though since these missiles are mobile, this number might be increased to a total of 40 in a crisis or conflict.

These weapons could be targeted on Japan's cities and with an estimated yield of 200 to 300 kilotons they would have a serious effect. A single weapon would kill over one-half million people in Tokyo though even in this case it would probably require multiple weapons to stop the city from functioning. With the higher yield and resulting greater lethal radius, combined with the DF-21 having greater accuracy compared to the *Nodong*, China could effectively target military targets in Japan, including, if they were to exist, Japan's nuclear forces.

China could also pose a threat of conventional invasion to Japan. For a number of years China has been developing amphibious forces that could potentially be used to occupy Taiwan. Japan's main islands are significantly farther away from China than is Taiwan and China might have a hard time conducting a direct invasion of Japan's main islands from China. However, the disputed Senkaku Islands are only 330 kilometers away from China's mainland. If an armed conflict were to break out over these islands, it is possible that China might also occupy the lightly populated and defended Japanese islands in the southern Ryukyu Island chain. The most western of these islands, Yonaguni Island, is only 100 kilometers east of Taiwan. From this island, China could work its way up the island chain to Miyako Island. From there the Chinese would be in reach of Okinawa. In the worst case, China could continue to advance up the island chain past Okinawa to Kyushu and the rest of the Japanese main islands.

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19. Hans M. Kristensen and Robert S. Norris, "Chinese nuclear forces, 2016," *Bulletin of the Atomic Scientists* 72, no. 4, June 13, 2016, pp. 205-211.

## Japanese Ballistic Missile Defense

Since 2003 Japan has made major investments in ballistic missile defenses which would help counter the nuclear-armed ballistic missile threat from China and especially North Korea. Japan has six Aegis destroyers equipped with SM-3 Block IA missiles. Japan has also deployed and upgraded various land-based radars to assist in ballistic missile detection and tracking. Together these systems allow Japan to conduct mid-course interceptions over a broad area. Two destroyers are sufficient to cover Japan's four main islands. Japan also has a short-range terminal defense layer consisting of 17 Patriot-3 missile batteries deployed mainly around Japan's major cities.

Japan is continuing to expand and upgrade these defenses. Japan will deploy two additional Aegis destroyers by 2020. Japan also hopes to begin deploying the more advanced SM-3 Block IIA missile on its Aegis ships by 2018.

How effective such a defense would be is unknown but it is generally agreed that it would be significantly less than 100%. Still, against a small North Korean attack aimed at Japan's major cities, there would be a significant chance that most if not all of the attacking missiles would be destroyed. This fact could give the North Koreans pause but if they were in a position to want to attack Japan with nuclear weapons, they would probably be so desperate that it might not matter.

Japan's ballistic missile defenses are probably significantly less effective against the more advanced Chinese ballistic missiles and re-entry vehicles. This might change somewhat with the deployment of the SM-3 Block IIA Aegis missile but given the size and sophistication of a possible Chinese nuclear attack, Japan's ballistic missile defenses are probably only a complication rather than a deterrent.

### *Japan's Starting Point*

Any nuclear weapons program needs three elements: The fissile material, i.e. plutonium (Pu) or highly enriched uranium (HEU), the non-nuclear weapon components needed to detonate the fissile material, and some means to deliver the weapons. The non-nuclear weapon components are the least specialized of these three elements, consisting of high explosives, fuses, and detonators. These are all items with which Japan's military are very familiar. These items would have to be properly configured and repeatedly tested without the fissile material, in order to produce a nuclear weapon. However, this whole process could be performed in two to six months prior to or in parallel with Japan's production of the fissile material components for a nuclear weapon.

Producing the fissile material for the weapons is usually the most difficult part of any nuclear weapon program but an examination of Japan's nuclear power industry shows that Japan is well on its way to acquiring the needed fissile material. Similarly, Japan's current military fighter aircraft and space launch industry provides Japan with several nuclear weapon delivery options.

### Japan's Nuclear Power Industry

Japan has an extensive nuclear power industry which could serve as a source of fissile material for a nuclear weapon program. Before the 2011 earthquake, Japan had 54 operating nuclear reactors with a capacity of 47,115 megawatts electrical (MWe). The tsunami following the earthquake destroyed four of these reactors, leaving Japan with 50 reactors with a capacity of 44,396 MWe. All 50 reactors were at one time shutdown due to the need for safety revaluations imposed by Japan's new Nuclear Regulation Authority (NRA). Thus far only 25 of the 50 reactors have applied to restart. Only five of these reactors have been restarted though two of these have been shut down again. It is unknown how many of the other 25 reactors will even apply to the NRA for restart and how many reactors will never restart.



Japan has opted for the so-called “closed” fuel cycle, meaning that it intends to reprocess all of the spent fuel from its nuclear power reactors to recover the plutonium. Japan has constructed two reprocessing plants. The Tokai reprocessing plant operated from 1977 to 2006. The plant was put into cold stand-by in 2006 and it was only in 2014 that the decision was taken to permanently shut down the plant though it could be years before the actual decommissioning takes place. The plant has a capacity of 210 metric tons of uranium (MtU) per year but it only processed a total of only 1,140 MtU during the thirty years that it operated. Japan has also built the Rokkasho reprocessing plant with a capacity of 800 MtU per year. This plant was supposed to start operation in 2008 but due to various problems it will not operate before mid-2018 at the earliest. Also between 1969 and 2001, Japan sent 7,100 metric tons (Mt) of spent fuel to France and the UK for reprocessing.

The original intention was for this plutonium to be used in fast breeder reactors. However, such reactors have not been successful world-wide. Japan’s own fast breeder reactor prototype at Monju has been plagued by accidents and is to be permanently shut down. Japan does not expect fast breeder reactors to be in operation until at least 2050. Instead, Japan intends to use the plutonium as mixed oxide (MOX) fuel in its current power reactors. However, this program has started slowly and was further delayed by the reactor shut downs in the aftermath of the 2011 earthquake. This has resulted in Japan acquiring a substantial stockpile of separated plutonium. As of the end of 2015, Japan had 10.8 metric tons stored in Japan itself and an additional 37.1 metric tons stored in the UK and France.<sup>20</sup>

Japan also has a centrifuge uranium enrichment plant at Rokkasho intended to produce low-enriched uranium for use as power reactor fuel. The plant started operation in 1992 but it was never able to operate at its design capacity due to numerous centrifuge failures. By 2011 the plant was barely operating but now new centrifuges of an

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20. Cabinet Office, Office of Atomic Energy Policy [Japan], “The Status Report of Plutonium Management in Japan-2015,” July 27, 2016.

improved design are being installed. The current capacity is 75,000 separative work units (SWU) per year and by 2022 it is supposed to reach 1,500,000 SWU/yr.

One important nuclear resource that Japan is lacking is uranium itself. It does not produce any uranium and has no uranium resources. If all of its nuclear reactors were operating Japan would require around 8,000 metric tons of uranium per year which is about 14% of the total world production. The possible implications of this fact for a Japanese nuclear weapons program are discussed below.

### Japan's Military Fighter Aircraft

Japan currently has about 200 F-15Js and 90 F-2A/Bs.<sup>21</sup> Japan is also beginning to deploy the new F-35. Of these three different aircraft types, the F-15s have a somewhat longer range and payload and would likely be the best nuclear delivery vehicle. The F-2s and F-35s would also be capable of delivering a nuclear weapon. These aircraft are stationed at six air bases. One air base is on Hokkaido, two on Honshu, two on Kyushu and one on Okinawa.

### Japan's Space Launch Capability

Japan has had a space launch industry for many decades. Its main space launch vehicle is the liquid-fueled H-II. However, Japan has also developed a number of different solid-fueled rockets, some of which serve as strap-on boosters to the H-II and some were developed as stages for stand-alone solid-fueled space launchers. Japan's latest solid-fueled launcher is the Epsilon rocket. It had its first successful launch on September 14, 2013. The three-stage rocket weighs 91 metric tons at launch and can place a 500 kilograms payload into low earth orbit. In the past, some in Japan have suggested

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21. *The Military Balance 2016*, London: International Institute for Strategic Studies, 2016.

that the solid-fueled launcher program should be eliminated and that Japan should rely solely on the more capable liquid-fueled H-II. However, national security arguments have been made in favor of Japan's solid-fueled rocket program, in that it provides Japan with a potential ballistic missile capability.

### *A Potential Japanese Nuclear Force*

#### Japanese Nuclear Weapons

Implosion fission weapons are the first type of weapon that Japan would likely produce. Japan's current stockpile of 10.8 metric tons of separated plutonium could be used to produce about 1,800 implosion fission weapons (assuming about 6 kilograms of plutonium per weapon). Most of this plutonium is from relatively high burnup fuel so that it is only 65% to 70% fissile. Implosion fission weapons made from such plutonium would have expected yields of about five kilotons.<sup>22</sup>

Most of Japan's plutonium stockpile is not in the form of pure plutonium compounds but rather is mixed with uranium or even actually manufactured into MOX fuel. Since this material is not highly radioactive, it would be a simple matter for Japan to chemically separate the plutonium from the uranium.

Japan's centrifuge enrichment facility is designed to produce low enriched uranium, but Japan could easily and quickly convert the enrichment facility to produce HEU. With its current 75,000 SWU/yr capacity, Japan could produce about 390 kilograms of HEU per year which would be enough for about 20 implosion fission weapons per year. If the enrichment plant achieves its full design capacity in 2022 of 1,500,000 SWU/yr, then Japan could produce as

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22. Gregory S. Jones, "The Myth of 'Denatured' Plutonium, Reactor-Grade Plutonium and Nuclear Weapons, Part Three: Predetonation," October 25, 2016.

much as 7.8 metric tons of HEU per year. This latter rate of production would be greatly in excess of Japan's needs and any actual production would be determined by Japan's weapon requirements and the availability of natural uranium feed.

This HEU could be used to produce 10-20 kiloton yield implosion fission weapons. Another option would be for the plutonium and HEU to be used together in the weapon core. The development of tactical aircraft/tactical ballistic missile-deliverable implosion fission weapons would require between zero and three nuclear tests.

Japan could also use its large stocks of plutonium in boosted fission weapons. Such weapons could produce yields in the range of 10 to 50 kilotons without the risk of predetonation. The production of such weapons would require Japan to have a source of tritium, which would mean being able to irradiate lithium in a nuclear reactor. The simplest way for Japan to achieve this goal would be to use one of its nuclear power reactors to produce the tritium, as the United States is doing at the Watts Bar power reactor.<sup>23</sup> Using just one of its nuclear power reactors for tritium production would allow Japan to produce hundreds of boosted fission weapons from its plutonium stocks. Developing boosted fission weapons would probably require zero to four additional nuclear tests (depending on how much outside nuclear design assistance Japan received) beyond those required to develop a deliverable implosion fission weapon, which would make a total of zero to seven nuclear tests.

Another option for Japan is to develop high yield pure fission weapons similar to the device that the United States tested in 1952 as the KING test in the IVY test series. Such weapons could produce yields of 500 kilotons or more at the expense of requiring very large quantities of HEU for each weapon. Developing such weapons would require a total of between zero and five nuclear tests, depending on how much outside nuclear design assistance Japan received.

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23. U.S. Department of Energy, *Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor*, (DOE/EIS-0288), Washington, DC: U.S. Department of Energy, 1999.

Ultimately Japan, like the other major nuclear weapon powers, might want to develop two-stage thermonuclear weapons. The development of a ballistic missile-deliverable, high yield warhead would likely require between 10 and 20 nuclear tests.<sup>24</sup> Such weapons could produce yields of 500 kilotons or more at the expense of requiring very large quantities of HEU for each weapon. Developing such weapons would require a total of between zero and five nuclear tests, depending on how much outside nuclear design assistance Japan received.

If Japan wanted to develop a light-weight multiple independently targetable reentry vehicle (MIRV) type warhead then a total of 15 to 30 tests might be required.<sup>25</sup> Japan would not be able to complete such an extensive nuclear testing program for many years. Also, as will be discussed below, Japan may have difficulty executing such a nuclear testing program since it is not clear that Japan has a satisfactory nuclear testing location.

### Japanese Nuclear Delivery Systems

In any consideration of Japanese nuclear weapon delivery systems one must take account of the range required to reach targets. Japan's main fighter bases could be a likely location for not only Japan's aircraft-delivered nuclear weapons but also for initial ballistic missile deployment. In the longer-term Japan could use surface ships operating east of Japan and ultimately ballistic missile submarines.

I envision three possible target sets. The first would be Chinese or North Korean cities. The second would be Chinese or North Korean nuclear forces. The third would be Chinese conventional forces conducting an invasion of Japanese islands.

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24. The actual KING device weighed about 4,000 kilograms. However, the British developed a variant (Orange Herald) which only weighed about 900 kilograms.

25. This would be a warhead similar to the French TN 71 warhead.

Japan has only recently become concerned about the security of its islands in the Ryukyu Island chain. It has proposed stationing “area security units” on these islands. However, these would only be small units and Japan is also developing rapid deployment divisions and brigades.<sup>26</sup> In the best case, Japan would anticipate an invasion and move these rapid deployment units to preempt any invasion. Otherwise these rapid deployment units would be used as amphibious forces to liberate any occupied islands. As Chinese conventional military forces become more capable this strategy may not be feasible and Japan might look to nuclear forces to defend these islands.

Since all of North Korea is not that far away from Japan, any North Korean city is reasonably close to Japan. Similarly, China’s largest cities tend to be on the coast. Naha airbase on Okinawa could be used by Japanese nuclear-armed aircraft to target cities in North Korea or China and nuclear weapons based on Okinawa would be well away from Japan’s main cities. Table 1 shows the range from Naha airbase to various cities in China and North Korea.

City Targeted	Range in Kilometers
Pyongyang	1,400
Shanghai	760
Beijing	1,900
Hong Kong	1,400

**Table 1. Range to Various Chinese and North Korean Cities from Naha Airbase, Okinawa.**

However, Okinawa could be vulnerable to attack, including a ground attack, so another possibility is for Japan to base its nuclear weapons at Tsuiki or Nyutabaru, which are fighter bases on Kyushu. Nyutabaru is potentially easier to protect since it is on the eastern part of the island. I have chosen it as a nominal location. Table 2 shows the range from Nyutabaru airbase to various cities in China and North Korea.

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26. See, Figure II-2-2-1 “Structure of Major GSDF Units,” *Defense of Japan*, 2016, Tokyo, 2016.

City Targeted	Range in Kilometers
Pyongyang	930
Shanghai	970
Beijing	1,600
Hong Kong	2,000

**Table 2. Range to Various Chinese and North Korean Cities from Nyutabaru Airbase, Kyushu.**

All of the distances are fairly short. Shanghai is less than 1,000 kilometers from either base and less than 800 kilometers from Naha. Pyongyang is less than 1,500 kilometers from either base and less than 1,000 kilometers from Nyutabaru. Beijing is less than 2,000 kilometers from either base and only 1,600 from Nyutabaru. Hong Kong is only about 1,400 kilometers from Naha and 2,000 kilometers from Nyutabaru.

North Korean nuclear forces will likely be located somewhere in North Korea and the distance to these forces will approximately be the same as that to Pyongyang. Chinese nuclear forces are spread more widely in China with some a great distance from the coast. To provide a general idea of the delivery ranges required, I used the seven reported Chinese nuclear weapon storage sites as nominal targets.<sup>27</sup> The site at Taibai is reported to be China's central nuclear weapon storage site where most of its nuclear weapons are stored. The other six sites, Shenyang, Luoyang, Huangshan, Huaihua, Kunming, and Xining are located at the installations that support China's various land-based ballistic missile units. The distances from Naha and Nyutabaru to these sites are shown in Tables 3 and 4.

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27. Mark A. Stokes, "China's Nuclear Warhead Storage and Handling System," Arlington, VA: Project 2049 Institute, March 12, 2010, p. 7.

<b>Site Targeted</b>	<b>Range in Kilometers</b>
Taibai	2,100
Shenyang	1,800
Luoyang	1,700
Huangshan	1,000
Huaihua	1,800
Kunming	2,500
Xining	2,600

**Table 3. Range to Chinese Nuclear Weapon Storage Sites from Naha Airbase, Okinawa.**

<b>Site Targeted</b>	<b>Range in Kilometers</b>
Taibai	2,200
Shenyang	1,300
Luoyang	1,800
Huangshan	1,300
Huaihua	2,100
Kunming	2,900
Xining	2,700

**Table 4. Range to Chinese Nuclear Weapon Storage Sites from Nyutabaru Airbase, Kyushu.**

Though these distances are somewhat longer than those to China's cities, they are still not that far. The distances to the three missile bases that would likely target Japan (Shenyang, Luoyang, and Huangshan) are less than 2,000 kilometers. Even China's farthest nuclear weapon storage sites are less than 3,000 kilometers from either of these Japanese airbases.

To defend against a conventional Chinese invasion of the Ryukyu Islands, Japan could take two approaches to its use of nuclear weapons. To try to limit escalation Japan might restrict its strikes to Japanese islands that are occupied by China and to Chinese naval forces



near these islands. The range to the farthest Japanese island (Yonaguni) in the Ryukyu Islands is about 500 kilometers from Naha and about 1,200 from Nyutabaru. Japan might also target Chinese air and naval bases on the mainland that were supporting the Chinese invasion forces though such strikes would entail a higher risk of escalation. These Chinese bases would be near the coast and I used the Chinese city of Fuzhou as a proxy for their location. The distance from Naha is 830 kilometers and the distance from Nyutabaru is 1,300 kilometers.

Japan's F-15 fighter interceptor aircraft could be fairly easily adapted to carry a nuclear bomb to a distance of about 1,000 kilometers. Exactly where the nuclear-armed F-15s would be based would not matter that much, since the aircraft could always stage through any of Japan's fighter bases when conducting an attack. In the longer-term Japan might want to equip these aircraft with air-to-surface missiles similar to the French *Air-Sol Moyenne Portée* (medium-range air to surface missile) with a range of 300 to 500 kilometers. Not only would such a missile extend the reach of the aircraft, they would also help protect them from air defenses.

Japan could also develop a nuclear-armed ballistic missile by adapting its solid-fueled space launch vehicles for this purpose. Japan's three-stage Epsilon rocket weighs over 90 metric tons and could fairly easily be adapted to produce an intercontinental ballistic missile (ICBM) but such a rocket would have far greater range than would be needed. In addition, the great weight of the Epsilon rocket would diminish its mobility.

Japan would initially only need a ballistic missile with a range of around 3,000 kilometers. Early French nuclear-armed ballistic missiles (such as the S-3 and M-2) were two-stage missiles which could deliver a single nuclear weapon weighing about 1,000 kilograms to ranges of 3,000 to 3,500 kilometers.<sup>28</sup> The missiles

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28. Pierre Langereux, "The M4, the First French Missile with Multiple Warheads, Will Become Operational in 1985 on the New Nuclear Submarine the 'Inflexible,'" *Air and Cosmos*, July 12, 1980.

weighed only 20 to 26 metric tons. Japan could create a satisfactory ballistic missile by combining the solid-fueled strap-on booster rocket for the H-II space launcher with one of the upper stages of the Epsilon rocket. In the longer-term Japan might want to develop a ballistic missile similar to the French M-4. This three-stage missile weighed about 35 metric tons and had a range of around 4,000 kilometers. This missile was MIRVed and could deliver six nuclear warheads. Japan may need to develop MIRVed ballistic missiles as its nuclear arsenal grows.

### *Stages of Japanese Nuclear Force Development*

To provide some idea of the time, cost, and resources needed to develop a Japanese nuclear force, I will examine several possible stages along the nuclear force development path. These stages are not meant to be comprehensive nor a prediction of the exact Japanese nuclear force development path.

#### Implosion Fission Weapons with F-15 delivery

Using its 10.8 metric ton stockpile of separated plutonium or HEU produced in its Rokkasho enrichment plant, Japan could rather quickly produce dozens of implosion fission weapons. It is not clear that any nuclear testing would be needed to develop these weapons. It would be fairly easy to deliver these weapons with F-15s. As was discussed above, Japan's air base at Nyutabaru would be a good location to base these aircraft. Aircraft at Nyutabaru could always stage through other Japanese air bases (such as Naha air base on Okinawa) to increase their range.

Such a force would probably be sufficient to match any North Korean nuclear arsenal. Though this force would be inferior to China's arsenal of thermonuclear weapons, the threat it posed to China's eastern cities could not be ignored. Additionally, aircraft delivered

bombs could be used tactically to defend the southern Ryukyu Islands from conventional attack.

Japan could probably develop such a nuclear force in less than one year and the overall cost would be perhaps in the low hundreds of millions of dollars. Such an expense could easily be absorbed by Japan's annual defense expenditures of around \$50 billion.

### Implosion Fission Weapons, F-15 & Ballistic Missile Delivery, No Submarine Basing

Though Japan's F-15s could probably penetrate North Korea's air defenses, and could be used tactically in the southern Ryukyu Islands, penetrating mainland China's air defenses could be more problematic. To supplement its aircraft delivered bombs, Japan could develop a 3,000 kilometer two-stage ballistic missile armed with a single implosion fission weapon from the solid rocket boosters it has developed for its space launch program. To develop and deploy a few dozen such missiles would require multiple missile developmental launches, probably over the space of several years and could cost roughly \$1 billion.

The easiest place for Japan to base these ballistic missiles would be on the two fighter bases on Kyushu. However, there would be a serious risk that China's nuclear-armed ballistic missiles could launch a preemptive attack on these bases or any other fixed land-based site. An interim solution might be to place the ballistic missiles on surface ships that could sail east of Japan. The air defenses on Japan proper along with the Japanese navy could help to protect the ships.

### Improved Fission Weapons, F-15 & Ballistic Missile Delivery, No Submarine Basing

An alternative to the case above is for Japan to try to develop somewhat improved nuclear weapons at the same time that it developed ballistic missiles. These could either be boosted fission weapons or KING-type weapons with significantly higher yields than those of implosion fission weapons. Depending on the extent of outside aid, it might not take any nuclear tests to develop these weapons or it could take up to five to seven tests. As was discussed above, boosted fission weapons would require Japan to produce tritium in one of its nuclear power reactors. KING-type weapons would require Japan to have a substantial uranium enrichment capacity. The development of either of these weapon types, including the required nuclear tests, if any, could be conducted in parallel to the development of the ballistic missiles. It would take several years and several billion dollars for Japan to reach this stage of nuclear force development.

### Two Stage Thermonuclear Weapons-Single Warheads, Conventionally-Powered Ballistic Missile Submarines, Ballistic Missile Surface Ships, F-15 Delivered Bombs

Ultimately, to match China's nuclear forces, Japan would want to develop two-stage thermonuclear weapons and deploy them on ballistic missile submarines. The development of two-stage thermonuclear weapons requires an extensive nuclear testing program. The goal would be a weapon with an approximately one megaton yield that could be delivered as a single warhead on a ballistic missile.

Japan has built a number of conventionally powered attack submarines. Japan could scale up these submarines to deliver nuclear-armed ballistic missiles. Rather than develop nuclear propulsion for these submarines, Japan might rely on air-independent propulsion technology as it has on its latest *Soryu*-class submarines. The submarines might each carry three to eight ballistic missiles. The development of such submarines would not be quick or inexpensive.

These submarines along with the required extensive nuclear weapon testing program would likely take at least a decade and tens of billions of dollars. At the same time, Japan might supplement these submarines with ballistic missiles deployed on surface ships and F-15 delivered boosted fission bombs. Japan's entire nuclear arsenal might be about 100 warheads.

### Two Stage Thermonuclear Weapons-MIRVed Warheads, Nuclear-Powered Ballistic Missile Submarines, F-15 Delivered Air-to-Surface Missiles

To be able to attack a wider-range of targets in China and to better match China's possibly expanding arsenal, Japan would need to develop a smaller lighter thermonuclear warhead with a yield of around 150 kilotons that could be used as MIRVed warheads on ballistic missiles. It would require extensive nuclear testing to develop such a warhead. At the same time, Japan could develop a ballistic missile similar to that of the French M4 with a range 4,000 kilometers and the ability to carry six such warheads.

To further increase the size of its nuclear arsenal, Japan would probably want to develop nuclear-powered ballistic missile submarines each carrying 16 ballistic missiles. I assume Japan would deploy four such submarines to ensure that at least one and perhaps two submarines were always on station.

The development of light-weight thermonuclear warheads would allow the development of air-to-surface missiles that could be delivered by F-15s. Such missiles could be similar to the French ASMP with a range of 300 to 500 kilometers and a warhead yield

of 300 kilotons. Japan might deploy 60 such missiles. Combined with the warheads carried on the ballistic missile submarines, Japan might have a total nuclear arsenal of about 350 warheads.<sup>29</sup> This ballistic missile submarine, air-to-surface missile force is similar to France's current nuclear force.<sup>30</sup>

To acquire such a nuclear force would require spending \$5 billion to \$10 billion per year over at least 15 to 20 years. Such expenditures would be 10 to 20% of Japan's current defense budget.

### Two Stage Thermonuclear Weapons-MIRVed Warheads, Nuclear-Powered Ballistic Missile Submarines, F-15 Delivered Air-to-Surface Missiles, Expanded Force

If China were to greatly expand its nuclear force, perhaps in response to Japan's nuclear arsenal, Japan might want to significantly further expand its nuclear force. This case is similar to the previous one except that Japan would deploy 12 ballistic missile submarines instead of just four and it would double its number of air-to-surface missiles to 120. This would produce a Japanese nuclear arsenal of around 1,000 warheads.

To produce such an arsenal would require spending \$10 billion to \$20 billion per year over at least twenty to thirty years. This would amount to 20 to 40% of Japan's current defense budget. Such a large expenditure would only be possible if Japan were to at least double its current defense spending.

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29. The French have only acquired three sets of ballistic missiles and nuclear warheads (288 warheads total) for four submarines since one submarine is always in overhaul.

30. There would be some differences. I envision Japan developing ballistic missile submarines similar to the older French Redoubtable-class rather than the current Triomphant-class and using TN 71 warheads instead of the current TN 75 warheads.

### *Problematic Aspects of a Japanese Nuclear Force*

There are a variety of issues that could pose problems for a Japanese nuclear weapons effort. These would include international reaction affecting alliance relations, international reaction affecting Japan's supply of uranium, the lack of a site for testing nuclear weapons and the overall adequacy of a potential Japanese nuclear force.

#### International Reaction, Alliance Relations

Any Japanese nuclear weapon effort would be bound to damage Japan relations with its alliance members, particularly the United States. One assumption made in the Motivators section (see above) was that there would already have been a major decline in the Japan-U.S. alliance and a further decline in the United States' relative power. If this were the case, Japan may not be concerned about U.S. reaction. Further reinforcing this view, Japan might note that both Pakistan and India were able to become nuclear weapon powers without provoking a strong U.S. reaction or sanctions.

#### International Reaction,Uranium

As was noted above, Japan does not produce uranium and has no uranium resources. It must depend solely on uranium imports. Some uranium producers, particularly Australia, have had strict policies regarding the use of their uranium in any manner in nuclear weapons programs. Australia's recent agreement to supply uranium to India may indicate that this policy is weakening. However, if Australia or other uranium producers were to enforce this policy after Japan began to deploy nuclear weapons, Japan might find it difficult to find the 8,000 metric tons per year of uranium needed for its large nuclear power program. In the aftermath of the 2011 earthquake only three of Japan's 50 nuclear power reactors are currently operating. If only a few reactors ever restart, then this lack of uranium would not be a problem but if a majority of the reactors

resume operation, the threat of the loss of uranium imports could form a serious brake on any potential Japanese nuclear weapons effort.

A uranium shortage would not directly be a serious problem for a Japanese nuclear weapons effort. In the short run, Japan could rely on its extensive holdings of separated plutonium. In the longer-run Japan could obtain uranium on the black market. The amount of uranium needed would be far less than is required by Japan's nuclear power program. Even if Japan could only obtain one percent (80 metric tons) of the amount of uranium needed by its nuclear power program each year, it could produce 400 kilograms of HEU per year which would probably be sufficient for Japan's nuclear weapons program. Each nuclear-powered submarine would require only about 10 metric tons of natural uranium per year to produce its enriched fuel.

Another option would be for Japan to create a large uranium stockpile, ostensibly for its civilian nuclear reactors, before it embarked on its nuclear weapons development. Japan's large number of nuclear reactors would make it easy to justify a stockpile of several thousand tons. Such a large uranium stockpile could supply a Japanese nuclear weapons effort for decades.

### A Site for Nuclear Weapons Testing

Japan would probably want to test its implosion fission weapons one or more times and if Japan embarks on the development of two-stage thermonuclear weapons it would require an extensive nuclear testing program. However, it will not be easy for Japan to find a location to conduct these nuclear tests.

The simplest way for Japan to conduct a nuclear test would be on a barge in the ocean hundreds of kilometers to the east of Japan. However, Japan is a signatory to the atmospheric nuclear test ban treaty and there have been no nuclear tests in the atmosphere since



1980. As a result, Japan would probably want to test underground. Japan would not want to test in Japan proper due to the high population density and the seismic instability of the islands. Japan controls a number of isolated islands but most of these are volcanic in nature which would make nuclear testing on them difficult. It may not be easy for Japan to find a suitable nuclear test site.

### The Adequacy of Japan's Nuclear Force

As was shown above, Japan could fairly quickly assemble a nuclear force consisting of implosion fission weapons delivered by F-15s. But it is not clear that such a force would be sufficient for use against either North Korea or China.

In the case of North Korea, certainly Japan could destroy Pyongyang and several other North Korean cities but then what? Japan would very likely only attack North Korea if North Korea had already used nuclear weapons. But if North Korea were already that desperate, would the threat of Japanese nuclear attack really deter North Korean nuclear use? And if North Korea had used nuclear weapons, it probably would have struck U.S. military and South Korean targets and would be facing retaliation from these countries. If that were the case, would the threat of Japanese nuclear retaliation add that much?

In the case of China, a Japanese nuclear force of implosion fission weapons delivered by F-15s would face a number of problems. Each of China's two-stage thermonuclear weapons would have over six times the destructive area of each of Japan's implosion fission weapons. F-15s might have difficulty reaching their targets in the face of China's air defenses and Japan's F-15 bases would be vulnerable to preemptive China nuclear attack. The only way Japan could be on an equal footing with China would be if Japan were to develop two-stage thermonuclear weapons and ballistic missile submarines. But as was discussed above such development would take at least a decade and tens of billions of dollars and could eventually take several decades and hundreds of billions of dollars. If

Japan embarks on such a nuclear weapons program, it should be prepared for a long expensive effort.

### *Summary and Conclusions*

There are various circumstances that are increasing the pressure on Japan to consider the development of its own nuclear weapons arsenal. North Korea has become a nuclear power and has shown itself to be a rather belligerent neighbor. Japan's territorial dispute with nuclear-armed China has escalated with Chinese military aircraft flying close to Japan and Chinese ships violating Japanese territorial waters. China has declared an air defense identification zone which includes the Japanese-controlled Senkaku Islands. Unofficial Chinese sources have suggested that China has a claim on the entire Ryukyu Island chain including Okinawa. South Korea, in response to North Korea's nuclear weapons tests and conventional military attacks, has suggested that it may acquire its own nuclear weapons. The decline of the United States relative to China over the past decade has weakened the credibility of the U.S. nuclear umbrella and has raised doubts as to whether the United States can prevail over China in the long run. Japan's aging and declining population will make it more difficult for Japan to maintain its conventional defense.

Japan already possesses many assets that have moved it close to the acquisition of nuclear weapons and their delivery systems. Japan has a stockpile of 10.8 metric tons of separated plutonium, which could be used to produce about 1,800 simple fission nuclear weapons. Japan has a centrifuge enrichment capacity which would allow it to produce 390 kilograms (20 weapons worth) of HEU each year. Japan plans to greatly expand its centrifuge enrichment facilities. Japan could deliver nuclear weapons using some of its F-15 fighters or develop 3,000-4,000 kilometer range ballistic missiles derived from

the solid-fueled rockets used in its space launch program.

If Japan does develop and deploy nuclear weapons, it would probably do so in stages. The first stage could consist of few dozen implosion fission weapons delivered by F-15s. Japan could probably produce such a force in less than a year and it would probably only cost in the range of hundreds of millions of dollars.

In the longer run Japan could develop a 3,000 kilometer range solid-fueled ballistic missile derived from its space launch program. Given the vulnerability of these missiles to a preemptive Chinese nuclear attack, Japan might want to base them on surface ships operating east of Japan, protected by the Japanese Air Force and Navy. The development of this ballistic missile would take several years and around one billion dollars.

At the same time as it develops a ballistic missile, Japan might want to develop improved fission warheads. These could be either boosted fission weapons or KING-type weapons. It could take Japan several years and several billion dollars to reach this stage of nuclear force development.

The ultimate goal for Japan would be to match China's nuclear force. This would require the development of two-stage thermonuclear weapons and basing the ballistic missiles on submarines. This could be done in stages. Japan's first thermonuclear weapons could have a yield of about one megaton and be used as a single warhead on ballistic missiles. Japan could develop submarines that are scaled up versions of the conventionally powered attack submarines that Japan has already built. Rather than develop nuclear propulsion for these submarines, Japan could use air-independent propulsion technology that it has used on its *Soryu*-class submarines. Three to eight ballistic missiles could be carried on each submarine. The development of such submarines along with the required extensive nuclear weapon testing program would likely take at least a decade and tens of billions of dollars.

Japan could then develop light-weight thermonuclear warheads

which could be deployed as MIRVs with six warheads per missiles. Japan could also develop nuclear-powered ballistic missile submarines which could carry 16 missiles per submarine and air-to-surface missiles for deployment of its F-15s. If Japan were to deploy four nuclear-powered submarines, then it would have a nuclear force similar to the one France has today with around 350 total nuclear weapons. To acquire such a nuclear force would require spending \$5 billion to \$10 billion per year over at least 15 to 20 years.

If Japan were to develop a much larger nuclear force with 12 nuclear-powered ballistic missile submarines and around 1,000 total weapons, then to produce such an arsenal would require spending \$10 billion to \$20 billion per year over at least 20 to 30 years.

There are a variety of issues that could pose problems for a Japanese nuclear weapons effort. First, Japan's development of nuclear weapons could threaten its international relations. It could weaken its alliance relationship with the United States although if U.S. power continues its relative decline compared to China it may not matter that much to Japan. International reaction could also lead to a cutoff of uranium supplies. This cutoff would not have much direct effect on Japan's nuclear weapons effort but if Japan manages to restart many of its nuclear power reactors, the cutoff could have a significant impact requiring Japan to import expensive fossil fuels. Second, Japan does not seem to have an adequate location to carry out an extensive nuclear testing program. Finding a solution to this problem does not appear to be easy. Finally, though Japan could quickly develop a nuclear force based on implosion fission weapons delivered by F-15s, in the long-run the only truly adequate nuclear force will require Japan to develop two-stage thermonuclear weapons and ballistic missiles based on nuclear-powered submarines. Such development would take at least a decade and tens of billions of dollars and could eventually take several decades and hundreds of billions of dollars. If Japan embarks on a nuclear weapons program it should be prepared for a long expensive effort.